

California Water Plan Update 2005
Analytical Tool Documentation
April 14th, 2006

1. Name of Tool: The California Agricultural Water Use Model
2. Author: California Department of Water Resources (Todd Hillaire, Northern District) and United States Bureau of Reclamation (Jim Cornwell, Mid-Pacific Region).
3. Availability of Technical Support:
 - 1) Website – None
 - 2) Users Manual – No user's manual is available at this time. However, the calculation methodology is outlined in a spreadsheet summary.
4. Applications:
 - 1) For the Water Plan Update, crops are analyzed by DAU/County subareas and aggregated to regional totals.
 - 2) Computes historical monthly time series data for unit values of crop evapotranspiration (ET), effective precipitation (EP) and evapotranspiration of applied water (ETAW), and applied water (AW). Crop acreage is input by water source type to develop volumes of applied surface water and applied groundwater.
5. Calibration / Validation / Sensitivity Analysis: Model output has been incorporated into DAU/County water budgets for mass balance assessment. Calibration/validation has not been performed since measured values of ET and ETAW are not available and measured values of AW are limited. A sensitivity analysis can be performed independent of calibration/validation to test the sensitivity of model results against key input parameters. This process has not yet been performed.
6. Peer Review – No formal peer review.
7. Anatomy of Tool:
 - a) Conceptual Model: The primary objective of the California Agricultural Water Use Model (CAWU) is to simulate and aggregate volumes of on-farm crop consumptive use and applied water. CUWA simulates historical monthly on-farm consumptive and applied water use through input of crop, soil and water supply characteristics; climatic conditions; and crop management practices. Input data are developed for average on-farm conditions by crop type for a given region, typically a DAU/county subarea.
 - b) Theoretical Model: As a component of the CUWA, the ETAW Model uses a soil moisture balance to determine monthly on-farm crop consumptive use of irrigation water. The SCS Method for estimating rainfall-runoff is used to estimate soil water infiltration from daily precipitation. Crop management input parameters include planting and harvest dates,

managed allowable depletion, and degree of deficit irrigation. Monthly crop rooting curves define the soil moisture available for use. Analyzed together, monthly evaporative demand, crop coefficients, bare soil evaporation coefficients, on-farm management practices and rooting depth determine the need for applying irrigation water (ETAW) to meet minimum soil moisture requirements for crop production on a per-acre basis. The input of irrigation system characteristics and management practices (including cultural practices) determines on-farm unit applied water by water source type (e.g. surface water, groundwater, mixed water source). Acreage by water source type that represents a region's water supply infrastructure is used for calculating regional total on-farm volumes of ET, EP, ETAW and AW by water source type. The model can then aggregate data by various crops types and regional planning areas for analysis and presentation.

- c) Numerical Model: The ETAW Model component of CAWU uses a soil storage balance accounting to simulate on-farm crop consumptive use on a monthly time-step. CAWU then uses database functions to aggregate unit AW and volumes of ET, EP, ETAW and AW by user selected regional areas.

- d) Input and Output Data:

- i) Input

- a. Daily precipitation
- b. Monthly evaporation or ETo
- c. Infiltration curves (SCS Methodology)
- d. Infiltration curve adjustment for soil surface evaporation
- e. Available soil moisture storage
- f. Effective rooting depth
- g. Soil evaporation coefficients
- h. Soil evaporation layer depth
- i. Monthly deficit irrigation factors
- j. Monthly managed allowable depletion
- k. Monthly rooting depth factors
- l. Aerial precipitation correction factor
- m. Monthly crop coefficients
- n. Monthly crop coefficient time factor (percent of month)
- o. Acreage by crop by water source type (surface water, groundwater, and mixed water sources)
- p. Double crop acreage
- q. Ration of groundwater and surface water acreage for mixed source water acreage
- r. Monthly application fraction
- s. Monthly leaching fraction
- t. Monthly pre-irrigation (depth of application)
- u. Monthly frost protection (depth of application)
- v. Other monthly cultural practice (depth of application)
- w. Monthly non-ET cultural practices (depth of application)

- x. Irrigation application efficiency
 - ii) Output
 - a. Monthly and annual unit ET, EP, ETAW, and AW output
 - b. Monthly and annual consumed fraction values by crop
 - c. Aggregated regional crop and double acreage and irrigated land area output
 - d. Monthly and annual aggregated regional volumes of crop ET, EP, ETAW, and AW output
- e) Data Management: MS Access tables, queries, reports.
- f) Software: MS Access (Office 2000, 2003 compatible)
 - a. Availability of source: The source code is a combination of Access and Visual Basic